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PROGRESS REPORTS

FROM

EXPERIMENT STATIONS

SEASON 1956-57

TANGANYIKA TERRITORY
EASTERN PROVINCE

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PROGRESS REPORTS FROM EXPERIMENT STATIONS

The reports for the seasons up to and including 1950-51 were published in seasonal volumes; the following are still in print and available at 3/- per volume post free.

1923-25 (one volume), 1926-1927, 1931-32, 1934-35, 1935-36, 1942-43 and 1945-46 to 1950-51.

From 1951-52 the reports from each territory were published individually each season. A few of the 1951-52 reports are out of print, but all others are available post free at 1/- per report or 7/6d. for the seasonal set.

TANGANYIKA TERRITORY
EASTERN PROVINCE
PROGRESS REPORT FOR THE SEASON 1957

BY

R. SMITH and E. W. VALENTINE.

COTTON SEASON.

Planting: February to April.

Picking: July to December.

Legal uprooting dates by districts:

Kilosa, Kisarawe and Ulanga	31st October.
Morogoro (excluding Duthumi)	15th November.
Bagamoyo and Duthumi	30th November.
Rufiji	15th January.

Rainfall (Ilonga): December to June. 50·85 inches.

INTRODUCTION.

Ilonga Station.

Meteorology.—The total rainfall for the season was the highest yet recorded. Unusually heavy storms fell during April and early May. Distribution was good.

Staff.—Mr. Valentine returned from vacation leave in January and Mr. Smith was absent on vacation leave from March until the end of June.

Visitors.—During the year Mr. J. C. May and Mr. J. E. Peat visited the station; also the Minister for Natural Resources, Mr. A. E. Trotman; the Director of Agriculture, Mr. J. R. P. Soper; and the Chief Research Officer, Dr. A. C. Evans.

Numerous parties of African growers organised by the Department of Agriculture were shown round and given instruction in cultivation methods. Seven instructors are spending a year learning mainly about cotton growing. Representatives of various insecticide firms also came to discuss and assess the development of the insecticide market.

Visits.—Both the entomologist and the plant breeder toured in Eastern, Tanga and Northern Provinces, to observe district plots and general cotton growing. Mr. Valentine attended the entomological conference at Arusha and the Provincial Agricultural Officers' conference at Dar es Salaam, where insecticide application to cotton was discussed. Mr. Smith attended the committee of Agricultural Botany at Muguga.

Cotton Growing—General.

Conditions for cotton growing were generally good except in a few localised areas in the Province. Rainfall was extremely heavy during March, April and May. Adequate rain fell in January and February to

enable clearing and planting to be performed efficiently. Insect attack in cotton varied from area to area, depending on the proximity to bush country, the pattern of the food crops grown nearby and the times when these were planted. Insects were present in all areas and no cotton garden was seen that would not have profited from application of insecticide. The main pests were jassid, American bollworm, spiny bollworm, pink bollworm, and stainers.

Where cotton was planted early and well tended, and insecticide was used, yields were good. Several plots at Ilonga, Kissaki and Mikese gave yields of between 2,000 and 3,000 lb./acre seed cotton, and a number of native gardens in Kilosa district produced 2,000 lb.

Five district plots are spread across the main growing areas of Eastern Province, with a further plot near Handeni in Tanga Province. Results from all six plots show that February planting with insecticide use gives the highest yields, confirming the recommendations of last season.

The Department of Agriculture must be congratulated on the extension of these results to growers. In the Eastern Province the crop was mostly planted by the end of February, and a lively interest in cotton has been roused. In Kilosa district, eighty growers used insecticide and all were closely supervised and helped with instructions and demonstrations of insecticide application and good husbandry. To date the results from 57 of these growers are available, giving an average return of 996 lb./acre, with a highest individual yield of 2,556 lb./acre.

In the Eastern cotton areas of Tanganyika widespread use of insecticide with February planting is essential for increased production. To this end, the entomologist has travelled during the past season in Eastern, Tanga and Northern Provinces to observe the pest attack and make recommendations regarding pest control techniques. At Ilonga, he has conducted trials to reduce the cost of insecticide applications, and has compared commercial products of varying price.

That a good crop can be picked and a large profit made by the use of insecticide is appreciated by growers. The cost of insecticide entails a relatively large initial outlay by the growers, which they are anxious to recover, and these hopes and incentives appear to result in a great improvement in the level of cultivation that they attain. Other growers have seen the results achieved and it seems likely that the present general level of husbandry will improve. Thus dusting helps to achieve good husbandry instead of being merely an addition to it.

Care, however, must be taken to ensure that all operations in applying insecticide are performed properly, especially in the early stages of extension. This season at Ilonga and Handeni, poor yields were obtained from some dusted plots, owing mainly to the endeavours of operators to dust too large an area in one day. This resulted in

working late in the morning after the wind had risen and the operator had grown tired. As examples, at Ilonga average yields of dusted trials ranged from 582 to 2,340 lb./acre seed cotton, and at Handeni from 248 to 1,690 lb.

In practice it is easier to use dust than sprays. The cheap, simple Swaine duster is available, transport and application of dust are easy, and no water is required, an important point in the drier areas. The disadvantages of dust are that it is generally less effective than sprays, is washed off by rain, and must be applied when the air is still. Despite this, not one grower of the eighty using dust in Kilosa district has failed or been dissatisfied with it this season. The entomologist has had consistently better results with sprays at Ilonga, and next year it is hoped that comparative results for the various cotton areas will be obtained in district plots.

Cotton Cultivation Trials.

BY

R. SMITH.

Ilonga and District Plots.

The heavy rain of March, April and May affected trials; wet soil conditions made insecticide application difficult for operators, and the constant rain probably washed some insecticide off the plants. 10% DDT and 3% BHC dust was used on all trials. Standing water and flooding occurred periodically at most sites of experiments. Nevertheless, high yields were obtained where conditions were not too extreme. It appears that in areas of higher rainfall (40″) and good soils (i.e., Kissaki, Kilombero, Kilosa and Mikese) yields of 2,000 lb./acre seed cotton can be expected. In the drier areas (20″-30″), under poorer growing conditions, yields of only 800-1,500 lb./acre can be expected, except in the valley bottoms.

Table 1.

Two trials at Ilonga, one planted in February, one in March, each of 2 Latin squares, three treatments. Plot size 1/100 acre. Insecticide used on both trials.

Yields in lb./acre seed cotton.

Planted.	*February.*	*March.*
Treatment.		
3 ft. between rows, 1 ft. between plants, 1 plant/hole ...	1607	401
3 ft. ,, ,, 1½ ,, ,, 2 ,, ,, ...	1567	402
3 ft. ,, ,, 3 ,, ,, 2 ,, ,, ...	1510	334
S.E.	66	59
Sign. Diff.	N.S.	N.S.
C. of V.	10%	36%

In a series of demonstration plots at Ilonga, February planted, dusted cotton gave the highest yield. The two spacing trials, one planted in February, the other in March, gave a similar result (Table 1). Spacings showed no significant difference but yields were higher in the closer spacings at both dates of planting.

The March plantings gave considerably lower yields than the February plantings, partly owing to attacks by pink bollworm and stainers in August, September and October before the bolls had opened. Picking of the February plantings had finished by 6th August.

The yields obtained for the pertinent treatments at each of the district plots are shown in Table 2.

TABLE 2.

Randomised plots in eight replications, 4 with insecticide, 4 without insecticide. 8 treatments, 4 earlier planted, 4 later planted at 4 different spacings.

Yields in lb./acre seed cotton, mean values for all spacings.

Site.	*Handeni.*	*Miono.*	*Mwaya.*	*Kissaki.*	*Mikese.*
Earlier planted:	23.2.57	27.2.57	22.2.27	8.2.57	4.2.57
Later planted:	1.3.57	6.4.57	29.3.57	20.3.57	27.2.57
Treatments.					
Earlier planted, dusted	260	654	663	1967	2064
Earlier planted, not dusted	nil	360	449	1338	1442
Later planted, dusted	237	408	470	1134	985
Later planted, not dusted	nil	110	321	1059	502
S.E.		31	47	70	61
Sign. Diff. (P = 0·05)		87	133	198	174
C. of V.		8%	10%	5%	5%

In all trials at all places both insecticide use and earlier planting gave significantly higher yields (P = 0·01).

The results for the spacing treatments were confusing and varied from place to place. The general trend, however, is reflected in the mean yields for all sites (Table 3). Differences were not significant but generally closer spacings gave the higher yields. Three feet between rows with one foot between plants, thinned to one plant per hole, still appears to be the best general recommendation for all areas.

TABLE 3.

Mean yields in lb./acre seed cotton for all sites.
Details as for Table 2.

	Dusted.	*Not dusted.*
Earlier planted.		
3 ft. between rows, 6″ between plants, 1 plant/hole ...	1121	735
3 ft. ,, ,, 12″ ,, ,, 1 ,, ,, ...	1289	696
3 ft. ,, ,, 18″ ,, ,, 2 ,, ,, ...	1039	772
3 ft. ,, ,, 36″ ,, ,, 2 ,, ,, ...	1040	670
Later planted.		
3 ft. between rows, 6″ between plants, 1 plant/hole ...	632	423
3 ft. ,, ,, 12″ ,, ,, 1 ,, ,, ...	751	456
3 ft. ,, ,, 18″ ,, ,, 2 ,, ,, ...	634	399
3 ft. ,, ,, 36″ ,, ,, 2 ,, ,, ...	573	317

Insects.

Weekly recordings at each plot traced the development of the insect attack by counts of damaged buds (flared squares) and analysis of shed bolls. Information was obtained on the period of insect attack and an estimate of the damage done by the various insects on dusted and not dusted cotton.

Both flared square and shed boll counts bear a direct relationship to the total flowering points produced and a comparative estimate of levels of insect attack at the various sites cannot be made.

Table 4 shows the period of pest attack and the proportional damage by the major pests. Observations were taken for 20 yds. of row for each spacing treatment at each site. Only the results for undusted cotton are shown.

TABLE 4.

Percentage damage by various insects at Ilonga and district plots.
Not dusted cotton, planted in February.

Site.	*Planting date.*	*ABW.*	*Pink bollworm.*	*Spiny bollworm.*	*Stainers.*	*Main period of crop loss.*
Kissaki	8.2.57	23	6	27	44	15.4– 6.7
Mikese	4.2.57	60	4	9	27	15.5–13.7
Ilonga	1.2.57	47	12	28	13	30.3– 8.6
Miono	27.2.57	59	1	16	24	15.5–20.7
Handeni	23.2.57	36	13	50	1	1.6–27.7
Mwaya	22.2.57	25	20	18	37	4.5–22.6

All district plots were later in developing pest attack than Ilonga. This was possibly due to a later planting date at Miono, Handeni and Mwaya and a six week dry period following planting at Kissaki and Mikese, numerous fruiting points not developing until April. 47/10 was planted at all sites except Handeni, in Tanga Province, where the local commercial variety, Uk51, was used. Uk51 is slower fruiting than 47/10 under local conditions and this could account for the later period of damage.

Observations in dusted and not dusted plots will be continued to get a clearer picture of insect attack in the various areas as a check on the effectiveness of insecticide applications.

PLANT BREEDING.

BY

R. SMITH.

Raingrown Types.

The present selected material has been obtained from genetically variable local stocks. The aims of the selection programme are to find

plants with good jassid resistance, high yield and good ginning outturn whilst maintaining the present lint quality. Assessment of these stocks has continued at Ilonga. Once a relatively stable population with a high gene frequency for the selection characteristics has been established it is proposed to continue selection by using the progeny row selection index technique. It is desirable under local conditions to keep trials small to ensure that insecticide is applied properly to all plots; for this the selection index technique is useful.

A small trial was laid down to assess the value of various characters to be measured for use in a selection index. The results have yet to be analysed.

Ilonga 58, a multiline issue, is to be multiplied at Chabe by the Department of Agriculture in the coming season. It will eventually replace 47/10. Il58 has given an average increase in yield of 25% over 47/10 at Ilonga and district plots this season. The average increase in ginning outturn has been 2%. The results of spinning tests from the Shirley Institute are shown in Table 5.

TABLE 5.

Comparison of spinning qualities of Il58 and 47/10.

	Effective length.	*Stelometer strength reading.*	*Maturity ratio.*	*Standard fibre wt.*	*Corrected lea count × strength product.*	*Yarn appce.*
Ilonga.						
Il58	40	19·5	0·845	174	2104	3
47/10	41	19·5	0·765	175	2098	3
Wami.						
Il58	40	20·3	0·845	185	2064	3
47/10	40	18·6	0·775	191	1984	4

The results indicate that the Il58 samples were on the whole slightly better in quality than the 47/10 samples, having greater maturity.

Il58 consists of seven strains from two original parent types. All have given consistently higher yields than 47/10. Though not jassid resistant, all are more jassid tolerant than 47/10. The plant habit tends to be tall, a bad character where insecticide has to be used. However, where growing conditions are good and very high yields are obtainable, it seems doubtful whether a small compact type of plant will be capable of exploiting the yield potential of such an area or, conversely, be able to grow vigorously under the poorest growing conditions experienced in the province.

Main Variety Trial.

Some details of the strains grown at Ilonga and district plots in the main variety trial are shown in Table 6. Nine strains were compared in a 3 × 3 balanced lattice, 4 replications, plot size 1/242 acre. Insecticide dust was used on all trials.

TABLE 6.

MAIN VARIETY TRIAL.

Site.	*Ilonga.*			*Mikese.*			*Kissaki.*			*Miono.*			*Mwaya.*			*Handeni.*		
Date planted.	31.1.57			4.2.57			20.3.57			27.2.57			22.2.57			12.3.57		
Strains.	*Lint lb./ac.*	*G.O.T.*	*L.I.*	*Lint lb./ac.*	*G.O.T.*	*L.I.*	*Lint lb./ac.*	*G.O.T.*	*L.I.*	*Lint lb./ac.*	*G.O.T.*	*L.I.*	*Lint lb./ac.*	*G.O.T.*	*L.I.*	*Lint lb./ac.*	*G.O.T.*	*L.I.*
I158	755	29·3	3·7	908	31·3	4·3	367	30·8	4·1	244	30·8	4·0	229	30·8	3·9	548	32·5	4·6
47/10	414	27·5	3·6	880	29·5	3·7	280	29·5	3·9	221	30·0	3·7	196	28·8	3·4	503	30·7	4·4
53/128	700	28·8	3·8	913	31·0	4·2	434	30·8	4·1	203	31·7	4·1	260	31·5	4·2	489	32·5	4·8
*53/122	677	27·8	3·7	894	30·0	4·1	386	29·5	3·8	245	30·7	3·8	236	31·0	3·8	—	—	—
53/193	728	27·5	3·7	812	30·7	4·0	378	30·0	4·1	212	30·0	3·7	212	29·0	3·6	471	31·3	4·8
54/275	791	30·5	3·9	969	32·5	4·2	383	30·5	4·3	273	31·3	4·5	217	30·5	4·1	597	32·3	4·9
298	736	31·5	3·8	922	32·3	3·9	368	29·3	3·8	214	31·5	3·8	234	31·8	3·9	631	33·0	4·6
155	729	31·8	4·6	865	32·0	4·7	378	30·5	4·7	235	32·0	4·4	257	32·5	4·2	594	32·0	4·9
55	698	31·0	4·3	791	30·0	4·2	362	31·0	4·3	205	30·0	4·0	260	31·0	4·2	460	31·5	4·7
*Uk51	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	601	33·3	4·9
S.E.	81			67			54			24			25			63		
Sign. Diff. (P=0·05)	123			N.S.			80			N.S.			N.S.			N.S.		
C. of V.	12%			8%			15%			10%			11%			12%		

*53/122 was replaced at Handeni by Uk51, the commercial variety in Tanga Province.

The 1954 selections showed more resistance to jassid than 47/10, Il58 or the 1953 selections. They also gave higher ginning percentages and lint indices. The biggest yield differences were at Ilonga, where increases ranged from 64% to 91% more than 47/10. Next season all the most promising 1954 selections will be tested in this trial.

Raingrown Types Trial.

A trial to test 100 strains was planted at Ilonga in a triple lattice design with six replications, plot size 1/484 acre. The remaining 1954 and 1955 selections were tested against the original parent types, 47/10 and Local.

Of the strains selected for planting next year the mean value for selection characters is shown in Table 7.

TABLE 7.

Comparison of annual selections 1954 and 1955.

Group.	*Yield seed cotton lb./acre.*	*Mean lint length in mm's.*	*G.O.T.*	*Lint Index*
54	1648	36·7	30·5	4·2–23 strains
55	1413	36·5	30·7	4·3–23 strains
Parent types	1405	36·6	29·6	3·9
Local	862	37·1	30·0	4·1
47/10	970	37·0	28·8	3·6

1956 Selections.

216 selections made in 1956 were planted; 80 will be grown in a variety trial next year on Ilonga. Strains were discarded for poor habit and jassid susceptibility.

General.

Ginning percentages were higher this season than in the previous year. Samples of 47/10 ginned between 28% and 30%, compared with 25% last year. Lint indices also were higher, 47/10 giving 3·6 compared with 3·2 in 1956.

Considerable jassid was present and the later selected material has a relatively high level of resistance.

Irrigation Types—Ilonga.

A trial of possible types for irrigation was grown at Ilonga under rainfall conditions. The poorest yields were obtained from the imported long staple varieties from the Sudan. The lax habit and slow fruiting of these strains made control with insecticide difficult. None has any jassid resistance and several of them suffered severely from jassid attack early in the season. The varieties with no blackarm resistance suffered heavily from this disease.

The Uganda and Lake Province types yielded well, their jassid resistance being a distinct advantage. However, they tended to be more leafy and to fruit more slowly than the Ilonga selections, and their final yields were lower.

Control of insects by 'cotton dust' was not good. Average yields of the various groups are shown in Table 8.

TABLE 8.

Average yield of imported and local 'finer lint' types—Ilonga.

Group.	*No. of strains.*	*Yields lb./acre seed cotton.*
Sudan types	5	145
Uganda	5	572
Lake Province	2	407
Ilonga	20	676
Control—local raingrown types	4	761

Selections.

Within the Ilonga 'finer lint' strains 110 selections were made and 66 will be planted in the coming season. When making the selections, emphasis was laid on jassid resistance and higher lint index combined with fine lint.

Irrigation Types—Lumemo.

At Lumemo, the Tanganyika Agricultural Corporation trial irrigation farm in the Kilombero valley, 9 varieties were planted in observation plots. Planted in February, the varieties were mainly grown on rainfall. Conditions were not ideal. Flooding occurred periodically and insecticide applications were difficult. The results obtained, shown in Table 9, are similar to those obtained at Ilonga.

TABLE 9.

Results of 'finer lint' varieties planted in observation plots at Lumemo Trial Farm.

Plot size 1/20 acre. *Insecticide was used.*

Place of origin.	*Variety.*	*Lb./acre seed cotton.*	*G.O.T.*	*Mean lint length in mm's. (20 combed seeds).*
Sudan.	BAR 14/25	530	34·5	40·7
	Domains Sakel	363	37·0	40·4
	BAR 1730L	447	41·5	39·3
	Wilds 16/1	335	34·0	37·4
Uganda.	L3/42	670	34·0	36·3
	C(53)16	530	35·0	37·3
Lake Province.	0/457	921	33·0	35·5
Ilonga.	R90	977	31·0	38·1
	R157	921	31·5	38·5

The indications are that selection within the finer lint types of the local stocks will provide the best adapted varieties for any large scale irrigation project in the Rufiji Basin area.

Next year, the best varieties from the various countries will be planted to obtain further proof of the most suitable type. These varieties are to be planted at Lumemo, Mbarali and Ikowa.

Time of Planting.

Plots were also planted monthly, February to June, to find the optimum planting date at Lumemo. The February planting gave the highest yield. The results are shown in Table 10.

The cotton was mainly grown on rainfall. Where irrigation was used the soil capped and the water had difficulty in penetrating through the surface.

TABLE 10.

Yields of time of planting plots, Lumemo Trial Farm.
Plot size 1/54 acre. Yield in lb./acre seed cotton.

	Insecticide.	*No insecticide.*
February planted	947	452
March ,,	387	242
April ,,	210	108
May ,,	167	70

The differences in yield indicate that use of insecticide is essential for high yields. The main pests were American bollworm, spiny bollworm and stainers.

ENTOMOLOGY.

BY

E. W. VALENTINE.

American Bollworm (Heliothis armigera).

After the previous cotton season there were isolated records of bollworm larvae on riverside maize, pigeon peas and tomato up till mid November. For the next few weeks none was found. At the end of the year numbers began to build up on early maize, reaching a maximum in this crop in March and continuing until the middle of April. During this period larvae were feeding on other crops, notably pigeon pea, sunflower and groundnuts. In the latter crop, numbers gradually increased from late January, reaching a maximum in the second generation, at the end of March. This attack was undoubtedly the main source of subsequent infestation of cotton. Observed parasitism ranged between 27% and 57% of weekly collections made during the two months (500 larvae recorded), but this did not prevent larval populations from exceeding 4,000 per acre.

Egg laying began in cotton in mid March and the damaged bud count had reached a sufficiently high level to begin spraying a month later. Soon after this there was a rather rapid natural decline in numbers of larvae, as well as that caused by insecticidal control, which was presumed to be due to the failure of young larvae to survive through the almost continuous rain. Thereafter the population remained at a relatively low level in cotton, but increased in chickpea and particularly in pigeon pea, between July and October.

After mid October the only records were from bonavist bean.

Spiny Bollworm (*Earias spp.*).

Spiny bollworm came into cotton at the same time as American bollworm, but in relatively small numbers early in the season. The infestation increased slightly in the trials during the protection period and eventually was greater than that of American bollworm. In the two weeks after the end of routine spraying there was a rapid increase followed by an equally rapid decline.

Pink Bollworm (*Platyedra gossypiella*).

Little trouble was encountered from this pest in the earlier planted crops, but it was responsible for the loss of a high proportion of the late bolls on the March planted plots. Late in the year, after Ilonga cotton had been uprooted, many larvae were found in untended gardens outside the station.

Stainers (*Dysdercus spp.*).

Early planted cotton was opening by the time these pests began to increase in numbers. *D. intermedius* was present throughout the whole season in small and variable numbers, but did not breed in cotton until July. At this time *D. fasciatus* bred very rapidly; it then left the crop after the first generation. Only in later planted crops was there any appreciable staining of lint.

Aphids.

At no time were aphids of any importance. After a mild infestation on seedlings they were not encountered again until the end of the rains, when they did not increase significantly.

Mites.

This season, red spider mites have assumed significance as pests on cotton. Small isolated colonies developed over the experimental area. Seemingly damaging infestations which built up in July, when the crop was opening, had little if any effect on yield. In the following month few specimens could be found on cotton, but there were breeding colonies on *Solanum spp.*, *Amaranthus blitum*, castor, cassava and *Hibiscus spp.*

Although most of the mites on Ilonga cotton occurred in plots which had been sprayed, infestations were also recorded in the district where no insecticides had been used. Greater numbers were always found in *Solanum spp.* and *Amaranthus blitum* which seem to be among the normal indigenous hosts. Specimens have been identified as *Tetranychus curcubitae* (Rahman and Sapra).

Insecticide Trials.

by

E. W. VALENTINE.

All insecticide trials were directed towards finding economies in spraying by varying the rates of application of DDT and BHC throughout the season. An objection to spraying under local conditions, apart from the necessity to provide for water, greater supervision and instruction, is its relatively high cost, so an attempt was made to reduce the total amount of insecticide used without greatly reducing efficiency.

The standard application is 1 lb. DDT per acre per week over a period of two months, with the inclusion of $\frac{1}{4}$ lb. BHC as an aphicide if required.

Trial No. 1.

As the greatest amount of crop loss due to American bollworm takes place during the period of formation of buds and small bolls, it was considered that if adequate protection were given during the first month—up to the peak of flowering—the rate of application could be reduced during the second month. Alternatively, the rate could be reduced in each second week to a level just sufficient to prevent the pest population from increasing above that of the previous week.

The variation in rates of application is set out in Table 11.

Table 11.

Plot size: 1/20th acre. Layout: randomised block. Replications: 4. Spacing: single plants at 1 ft. spacing in 42 inch rows. Strain: Il58. Equipment: Four Oaks Ross knapsack sprayer with Allman 000 nozzles. Insecticide applied weekly for 8 weeks in 8 gallons of water per acre.

DDT lb./acre/week		*Total*	*Cost per acre as*		*Seed cotton lb./acre*	
1st month	*2nd month*	*lb. DDT*	*Shs.*	*Lb. s/c.*	*Total*	*Net*
1	1	8	100	182	1,825	1,643
1	$\frac{1}{2}$	6	75	136	1,535	1,399
1	$\frac{1}{4}$	5	62·5	114	1,570	1,456
1	0	4	50	91	1,250	1,159
1 and $\frac{1}{4}$	alternating	6	75	136	1,640	1,504
1 and $\frac{1}{4}$	,,	5	62·5	114	1,545	1,431
S.E.					144	
Sign. Diff. (P=0·05)					306	
C. of V.					9%	

Discussion.—Part of this trial became waterlogged at times owing to heavy rain during April and May, causing a wide plot to plot variation. The wetter parts suffered loss due to boll rots and did not open as well as those parts which were not affected by standing water.

The "standard" treatment of 1 lb. DDT per acre per application gave the highest yield and the greatest net return.

Where the total amount of insecticide was reduced, either by applying lower rates in the second month or by alternating high and low applications, good control was still achieved. There seems to be an advantage in the "alternating" system over the simple reduction in the second month, although the yields were not significantly different. Neither of these variations gave the same economic return as the constant high rate.

Trial No. 2.

The inclusion of BHC in a spray is recommended as an insurance against possible aphid attack and to assist in the control of those insects which are not as effectively controlled by DDT. This adds considerably to the cost of treatments if continued throughout the whole spraying period. It was considered that if cotton is planted relatively early so that the crop is nearer maturity by the time of the expected end of the rains, an aphicide would be needed only in the last few weeks of the season. A comparison was made between applications of DDT only, DDT plus BHC during two months, and the addition of BHC in the second month only.

Table 12.

Plot size: 1/20th acre, with 5 yds. unsprayed strips between plots. Layout: randomised blocks. Replications: 5. Spacing: single plants at 1 ft. spacing in 42 inch rows. Strain: I158 (guards 51/77). Equipment: Four Oaks knapsack sprayer with Allman 000 nozzles. Insecticide applied weekly for 8 weeks in 8 gallons of water per acre.

Lb./acre/week		*Total lb.*		*Cost per acre as*		*Seed cotton lb./acre*	
DDT	*BHC*	*DDT*	*BHC*	*Shs.*	*Lb. s/c.*	*Total*	*Net*
1	—	8	—	100	182	1,932	1,750
½	—	4	—	50	91	1,536	1,445
1	¼	8	2	230	418	2,068	1,650
½	¼	4	2	180	327	1,612	1,285
1	¼*	8	1	165	300	1,904	1,604
½	¼*	4	1	105	191	1,668	1,477
S.E.						130	
Sign. Diff. (P=0·05)						272	
C. of V.						7%	

Unsprayed strips: average 774 lb. seed cotton per acre.

*=2nd month only.

Discussion.—The addition of BHC has never been found to reduce significantly the numbers of American bollworm, but is useful in the prevention of build-up of aphid and for better control of pink bollworm. This season, however, an aphid attack did not occur, owing in the main

to the almost continuous rain during the development of the crop. At the onset of dry weather when conditions were more favourable for aphid development, bolls were also nearer maturity. Pink bollworm was less troublesome than in the later (March) plantings.

The addition of BHC in general led to slightly higher yields, but in no case were they significantly greater than for DDT alone, and the treatments including BHC for the second half of the protection period were as effective as those in which BHC was used for the whole period. A higher (1 lb.) application of DDT again gave a better net return.

The most economical treatment seems to be the application of 1 lb. DDT per acre per week, with the addition of BHC when it is required. This, however, requires some adjustment and it may be wiser for a general recommendation to include BHC at least in the second month, especially where cotton is planted late.

Trial No. 3.

Another possibility for reducing costs is the use of the cheaper locally formulated insecticides. Standard nozzles would also help a little to reduce the cost of equipment, special fittings and replacements.

A small area in addition to that required for the main trials was used to make a comparison between emulsions from different sources. One supply was of emulsions "locally formulated", and the other of "imported" materials. Swirl nozzles which give a fairly coarse spray were also compared with fine ceramic nozzles.

TABLE 13.

Plot size: 1/35th acre. Layout: randomised blocks. Replications: 3. Spacing: single plants at 1 ft. spacing in 42 inch rows. Strain: Il58. Equipment: Four Oaks Ross knapsack sprayers with standard "swirl" nozzles and Allman 000 nozzles. Insecticide applied weekly for 8 weeks in 8 gallons of water. Insecticide used: "imported" DDT and BHC emulsion; and cheap "locally formulated" emulsions.

All applications at 1 lb. DDT + ¼ lb. BHC per acre per week.

				Seed cotton lb./acre.	
Treatment.	*Insecticide.*	*Nozzle.*	*Cost/acre.*	*Total.*	*Net.*
A	Imported	Allman 000	230/-	2,900	2,482
B	Imported	Swirl	230/-	2,818	2,400
C	Local	Allman 000	128/-	2,254	2,021
D	Local	Swirl	128/-	2,358	2,125
S.E.				175	
Sign. Diff. (P=0·05)				429	
C. of V.				7%	

Discussion.—Yields from this trial were very satisfactory, as they represent the highest yields obtained from a standard insecticide treatment. The highest plot yield was equivalent to over 3,000 lb. seed cotton per acre.

All treatments gave very good control. The better quality insecticide gave the highest yields, and although much more expensive, also the greatest net return.

There was no significant difference between the "coarse" and "fine" sprays in final yields, but the pest records indicate that the coarse sprays may be a little more effective in the control of spiny bollworm.

General Note on the Extension of Pest Control into African Agriculture.

During the 1957 season a concerted effort was made by the Agricultural Department to extend pest control into African cotton areas in the Kilosa district where 80 growers dusted their cotton crops. The rate of application was 8 lb. of "cotton dust" (10% DDT + 3% BHC) per acre per week for 8 weeks. The very satisfying yields, which are summarised in the introduction to this report, are the results of close supervision by field staff, and the insistence on timely planting, and a high standard of cultivation, as well as the proper use of insecticide. Successes by these farmers should encourage not only an increased interest in the use of insecticide, but also an improvement in the general standard of cultivation. Next season it is expected that three hundred or more growers will use dusts on their own account in the Kilosa district, and in the Chabe seed multiplication area approximately 300 acres of cotton will be dusted under the supervision of Agricultural Department Instructors. Experience in this latter scheme will provide useful information for the further extension of pest control measures into other parts of the province.

The Department's policy is that initial extension should be with dusts, but it is hoped in the future, when growers have sufficient experience and a proper appreciation of the value of pest control, that where it is practicable a change will be made to more efficient spraying techniques. How this is done will depend on the field staff's evolving an organisation for distribution and instruction suited to the conditions. However, the answer to the problem of increased production does not lie solely in the use of insecticide, but in the improvement of cultivation, early planting to increase potential yield and to avoid heavy aphid and stainer attack, and a strict adherence to the close season. On the plant breeding side advances can be made in jassid resistance and more rapid fruiting varieties.

APPENDIX.

SUMMARY OF STRAINS.

Eastern Province Local	The original commercial cotton in the Province, mainly of Uganda Local origin. Strains prefixed by the figures 44-58, which indicate the year of origin, are all selections or re-selections from Local.
47/10	A selection from Local; the current commercial cotton of the Province.
I158	A multiline issue composed of 7 strains with improved yield and ginning outturn, to be multiplied for eventual distribution in place of 47/10.
Uk51	The current commercial cotton in the Lake and Tanga Provinces.

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